SEDONA GEOLOGIC

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December 6, 2012
File No.: SG-1112-01

Mr. Henry Tosta
Henry Tosta Dairy
20662 San Jose Road
Tracy, California 95304

SUBJECT: Limited Groundwater Assessment Report
Dead Animal Burial Area
Reeve Road Heifer Ranch
21070 Reeve Road
Tracy, San Joaquin County, California

Dear Mr. Tosta:

Sedona Geologic is pleased to provide this limited groundwater assessment report (report) for the Reeve Road Heifer Ranch located at 21070 Reeve Road, Tracy, San Joaquin County, California (Site). This report was prepared at your request.

Sedona Geologic appreciates the opportunity to be of service to Henry Tosta Dairy. Please call (559) 304-6076, if you have any questions.

Respectfully Submitted,

SEDONA GEOLOGIC

DRAFT
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Chris Skelton, PG 7414
Principal Geologist

Distribution: Mr. Henry Tosta
Mr. David Avila

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

LIMITED GROUNDWATER ASSESSMENT REPORT
DEAD ANIMAL BURIAL AREA
REEVE ROAD HEIFER RANCH
21070 REEVE ROAD
TRACY, SAN JOAQUIN COUNTY, CALIFORNIA

1.0 INTRODUCTION

Sedona Geologic has prepared this report on behalf of Henry Tosta Dairy to document the characterization of shallow groundwater below the dead animal burial area at the Reeve Road Heifer Ranch (Site) in San Joaquin County, California.

The Site lies within an agricultural area that has likely been farmed since the 1950's. Historic agricultural activity and associated irrigation and fertilizer application impacts are unknown, but historical sources within the vicinity are documented to have contributed to overall degradation of water quality. Studies conducted by others suggest that due to extended residence times and mixing of groundwater of different ages, the maximum effect of the degradation of water quality from land practices at the surface may not be reached until decades to centuries of gradual decline in groundwater quality.

The following report documents the procedures used to explore subsurface conditions beneath the reported burial area and sample groundwater at the Site. The objective of the assessment is to explore soil and first-encountered groundwater at the Site with respect to sources of constituents of concern that may have been released within the Site and vicinity. This groundwater assessment was limited, chiefly by budget constraints, to the collection and analyses of representative groundwater samples in the dead animal burial area. Groundwater elevation data was not available. Groundwater flow conditions are inferred conceptually.

1.1 Background

The Regional Water Board conducted an inspection of the Site on May 1, 2012. The inspection was conducted in response to a request for closure. At the time of the inspection, Water Board staff identified the burial of dead animals in an area north of the facility and adjacent to the Main Drain Canal. The inspection revealed animals were buried just below the ground surface in shallow pits. The number of pits was reported as "several;" however, only two pits are identified in the photographs appended to the inspection report.

On June 11, 2012, the Water Board issued a clean up and abatement order (CAO) for the Site. The CAO directed Henry Tosta to cease burial of dead animals, excavate and remove dead animals (remediation), and submit groundwater data (monitoring and reporting) for Water Board compliance review.

Western Dairy Design submitted *Comprehensive Report – Dead Animal Removal* dated July 18, 2012 (Comprehensive Report). The Comprehensive Report documents the excavation, observations, removal of animals, and groundwater analysis. Reportedly, a volume measuring approximately 425 feet in length, 35 feet in depth and 7 to 8 feet in depth was excavated and explored for the removal of dead animals. The Comprehensive Report indicated that the remains of approximately 8 to 12 animals were recognized during the removal and that Site conditions and farming management practices made it impossible to further identify a "whole" animal.

2.0 SITE DESCRIPTION

The Reeve Road Heifer Ranch is located at 21070 Reeve Road, San Joaquin County, California. The Site lies on the south margin of the Sacramento-San Joaquin Rivers Delta approximately 2½-miles northwest of Tracy, in Section 11 of Township 2 South, Range 4 East, Mount Diablo Base and Meridian (Figures 1 and 2). There appear to be approximately six neighboring confined animal feeding operation (CAFOs) within approximately 1½-miles of the Site. One CAFO is located adjacent to the Site (Figure 2).

The Site is relatively flat and slopes gently and uniformly from the foothills of the Diablo Range towards Old River to the northeast. Approximate Site elevations range from 15 (southwest) to less than 5 (northeast) feet above mean sea level. Old River is approximately one mile north of the facility and flows west. Main Drain Canal is adjacent to the north of the reported burial area and flows northwest (Figures 1, and 2).

2.1 Geology

The Site is located in the Great Valley Geomorphic Province consisting of marine and continental sedimentary rocks resting on a basement complex of metamorphic and igneous rocks. Surficial deposits are derived from the Sierra Nevada to the east, and the Coast Range to the west, and generally consist of alluvial fan deposits of sedimentary and meta-sedimentary rocks.

Continental deposits of Quaternary age crop out chiefly along the major rivers and streams of the valley as well as other low-lying areas; the deposits include river deposits, flood basin deposits, and sand dunes. River deposits, including channel and flood-plain deposits, are considered to be the most permeable deposits in the valley; in general, they are not tapped by wells. Flood-basin deposits consist largely of fine-grained beds that restrict the vertical movement of water.

The Site lies in the Quaternary flood-basin deposits consisting of unconsolidated Surficial and near surface deposits of clay, silt, sand and gravel reworked from alluvial fans and deposited on the flood plains along the rivers (Figure 3).

2.2 Hydrogeology

The Site is located in the Tracy Subbasin within the San Joaquin River Hydrologic Region. The Tracy Subbasin is comprised of continental deposits of Later Tertiary to Quaternary age. The Subbasin deposits include the Tulare Formation, older alluvium, younger alluvium, and flood-basin deposits. The Tulare Formation is exposed in the Diablo Range foothills along the western margin of the Subbasin. The Tulare Formation consists of semi-consolidated, poorly sorted, discontinuous deposits of clay, silt, and gravel. The Corcoran Clay member of the formation underlies the vicinity of the Site at depths ranging from 100 to 150 feet, with a thickness of approximately 50 feet, and acts as a confining layer. Groundwater above the Corcoran Clay is often of poor quality.

Older alluvium is composed of loosely to moderately compacted sand, silt and gravel deposited in alluvial fans during the Pliocene and Pleistocene. The Older alluvium is approximately 150 feet thick, moderately to locally highly permeable.

Flood-basin deposits occur in the northern two-thirds portion of the subbasin. They are distal equivalents of the Tulare Formation and older and younger alluvial units and consist chiefly of silts and clays. Because of the fine grained nature of these deposits, flood-basin deposits have low permeability. Occasional zones of fresh water are found in the flood-basin deposits.

Younger alluvium includes those deposits that are accumulating or would be accumulating under natural conditions. It includes sediments deposited in the channel of active streams as well as overbank deposits and terraces of those streams. These deposits are highly permeable. The thickness of the younger alluvium in the subbasin is approximately less than 100 feet.

There are three documented water-bearing zones in the subbasin. These include the lower zone, which contains confined fresh water below the Corcoran clay, an upper zone which may contain confined, semi-confined, and/or unconfined water above the Corcoran Clay, and a shallow zone which has unconfined water within about 25 feet of ground surface. Reportedly, head differences between the upper zone and lower zone create flowing wells.

Groundwater flow historically trends from areas south and west of the Site to the northeast and areas to the east of the Site flow north to northwest to Old River.

The groundwater quality in the northern area of subbasin is characterized by sodium and various anionic water types. Total dissolved solids concentrations range from 210 to 7,800 milligrams per liter (mg/L). Areas of poor water quality exist throughout the subbasin. Areas of elevated nitrate occur in the northwest portion of the subbasin and in the vicinity of Tracy (DWR 2006).

4.0 METHODOLOGY

Sedona Geologic explored subsurface conditions beneath the reported burial excavation area and researched readily available geologic information pertaining to the Site. The affected area is clay with shallow groundwater conditions and presumably, an adjacent source of recharge or discharge of groundwater depending on flow conditions in Main Drain Canal.

4.1 SOILS

Based on the reported geology of the Site and vicinity, the upper 100 feet of soil beneath the Site consists of Flood-basin deposits. Site soil information included NRCS soil survey information, a Site-specific soil investigation, and review of an historical soil investigation conducted in the vicinity by others. Soil conditions for the Site are described below.

4.1.1 NRCS Soil Survey

Soil classification for the Site was determined by the National Resource Conservation Service (NRCS) San Joaquin County-soil survey.

The NRCS soil surveys typically report conditions/characteristics of the upper five feet of soils. Based on the soil survey, there are two soil types identified at the Site: Egbert silty clay loam, partially drained, 0-2 percent slopes, and Willows clay, partially drained, 0-2 percent slopes. The soil types are discussed below. NRCS soil survey information is attached as Appendix A.

The soils in the vicinity of the burial area at the Site are predominantly Willows clay to the west and Egbert silty clay loam to the east.

The Willows clay was described as poorly drained highly plastic clays formed as basin floors with very low permeability. The Egbert silty clay loam was described as highly plastic clays formed on flood plains with low permeability.

4.1.2 Site Soil Conditions

Sedona Geologic advanced three soil borings (B-1, B-2, and B-3) to a depth of approximately 10 feet bgs in the reported burial excavation area at the Site to observe Site soils and collect groundwater samples. Boring B-1 was advanced in the central portion of the excavation area reported by Western Dairy Design. Borings B-2 and B-3 were advanced in the northwest area of the reported excavation area where a majority of the buried animals were identified. The boring locations are shown on Figure 4.

Soil borings were advanced using either a 2¾" or a 4" hand-auger. Soil samples were visually observed continuously for the length of the boring. No soil samples were retained for any testing or analysis due to budget constraints. Soils encountered consisted of an organic-rich clay at the surface and pale grey clay from the near surface

to depths of approximately 6-feet bgs. Pale brown clay was encountered beneath the pale grey clay and extended to the maximum depth explored. The soils were stiff to very stiff. There were no indications of animal remains in the soils observed.

4.1.3 Historical Soil Report

A Nitrate loading study was reported for the Henry Tosta Dairy in March 1999 by Valley Ag Research. Soils are reported by NRCS for the Henry Tosta Dairy as Egbert silty clay loam. Reportedly, a soil sample was collected at the Henry Tosta Dairy, and test results indicated a clay content of 34% and a hydraulic conductivity of 1.3×10^{-6} cm/sec.

4.2 GROUNDWATER

Based on the reported geology and hydrogeology, groundwater occurs within 25 feet of the surface in the shallow zone as reported by Hotchkiss and Balding. Groundwater information included reviews of readily available reports, a Site-specific field investigation, and reviews of historical groundwater investigations conducted by others in the Site vicinity.

4.2.1 Site Groundwater Conditions

Sedona Geologic advanced three soil borings (B-1, B-2, and B-3) to a depth of approximately 10 feet bgs in the reported burial excavation area at the Site to observe Site soils and collect groundwater samples. No flow was observed in the Main Drain Canal during the field investigation.

Soil borings were advanced using either a 2¾" or a 4" hand-auger. Soil samples were visually observed continuously for the length of the boring. Groundwater was encountered in the soil borings at depths of approximately 6 to 6½-feet bgs occurring at or near the transition zone between the clays described above.

4.2.2 Temporary Well Construction

The soil borings were advanced to approximately 10 feet bgs. Each soil boring was constructed into a temporary well. B-1 was constructed with 10 feet of 1¼-inch schedule 40 PVC pipe. The bottom five feet of the pipe was perforated in the field using a saw. Borings B-2 and B-3 were constructed of 5-feet of 2-inch diameter PVC blank casing, and 5-feet of 0.01-inch machine slotted well screen. A sand filter pack was placed from the bottom of the borings to approximately ½-1 foot above the well screen and consisted of #2/12 Monterey sand. Bentonite was used to temporarily seal the boring to the surface. Approximately 12-inches of well casing protrude from the ground surface. Each of the temporary wells was developed using a hand bailer. The temporary wells recharge slowly.

4.2.3 Groundwater Monitoring and Sampling

Groundwater samples were collected and submitted to a State of California-certified laboratory. The samples were analyzed for total and fecal coli forms, nitrate as

nitrogen, nitrite as nitrogen, ammonia as nitrogen, and total kjeldahl nitrogen (TKN). TKN represents the total organic nitrogen in the forms of ammonia and ammonium.

5.0 GROUNDWATER DATA SUMMARY

5.1 Historical Published Groundwater Review

Groundwater in Tracy-Dos Palos area was investigated by William Hotchkiss and Gary Balding in the late 1960's to early 1970's. The results of their work were published in an open file report numbered 72-169 of the United States Geological Survey (USGS). The report describes the geology and hydrogeology of the Site and vicinity.

Nitrate was reported at a concentration of 84 mg/L for a groundwater sample collected from well 2S/4E-9A1. The sample was collected on April 30, 1968 from the nearest well relative to the Site of all the wells identified in the report. Well 2S/4E-9A1 total depth was documented in the open file report as 76 feet bgs and represents the upper water bearing zone above the Corcoran Clay.

Additionally, the report documents historical groundwater quality in the vicinity of the Site. Some of the reported descriptions are provided below:

- "Water with dissolved solids in excess of 2,000 mg/L also occurs in the upper water bearing zone. These saline conditions are mostly exhibited by shallow wells that show chloride and sulfate type water. Most of these wells occur in the grasslands geomorphic unit where the saline-alkaline type soils predominate and the water table is less than 10 feet below land surface. Saline water also occurs in the chloride type water located northwest of Tracy"

- *"Chloride type*. – Chloride type groundwater occurs northwest of Tracy…. The concentration of dissolved solids in the chloride type groundwater northwest of Tracy is generally between 1,600 and 3,500 mg/L."

- "Chemical analyses used in this report were made during the period from 1959 to 1968."

- "North of Tracy, in Old River, the water is usually very hard and varies from a transitional (sodium calcium chloride bicarbonate) to a sodium chloride type."

- "Nitrate concentrations in the Tracy-Dos Palos area range from 0.0 to 1.180 mg/L in the upper water bearing zone above the Corcoran clay and from 0.0 to 89 mg/L in the lower water bearing zone below the Corcoran clay."

The State of California Department of Water Resources (DWR) Bulletin 118 documents hydrogeologic information for California's groundwater basins and subbasins. As updated on January 20, 2006, DWR's reported impairments for the Tracy Subbasin appear below:

- "Areas of poor water quality exist throughout the subbasin. Areas of elevated chloride occur in several areas including: along the western side of the subbasin; in the vicinity of the City of Tracy; and along the San Joaquin River. Areas of elevated nitrate occur in the northwestern part of the subbasin and in the vicinity of the City of Tracy."

5.2 Depth to Groundwater

Depth-to-groundwater measurements were gauged in temporary monitoring wells B-1, B-2, and B-3. Depth-to-groundwater measurements from ground surface ranged from approximately 5.4 to 6.3 feet on November 6, 2012.

5.3 Conceptual Groundwater Flow

Clayey soils, such as those observed at the Site significantly retard and restrict the flow of groundwater. Based on the topography, one would expect that groundwater similarly flows from areas of higher topographic elevation towards areas of lower topographic elevation to the north-northeast. Main Drain Canal is adjacent to the reported burial excavation area to the north. Shallow groundwater may likely be influenced by flow in Main Drain Canal.

5.4 Water Quality

The Site lies within an agricultural area that has known or suspected nitrogen sources within the vicinity which may have contributed to overall degradation of water quality since at least the 1950's. As reported by DWR, shallow groundwater for the Tracy Subbasin, in the vicinity of the Site is known to be impaired with regards to nitrates.

Field measured water quality parameters indicate elevated conductivity and pH and low oxidation-reduction potential. Shallow groundwater is characterized as saline-alkaline type groundwater in an anaerobic condition. Groundwater analytical results for temporary monitoring wells associated with the Site indicate nitrate and nitrite concentrations do not exceeded primary maximum contaminant levels. Tables 1 and 2 summarize the analytical results of groundwater samples collected from the temporary monitoring wells. Table 1 summarizes results of nitrogen forms and Table 2 summarizes the bacterial analyses. Laboratory reports with Chain-of-Custody documentation are provided in Appendix B.

6.0 FINDINGS

Human activities that contribute to nitrate impairments of groundwater: confined animal operations, crop fertilization, wastewater treatment discharge and septic systems, are a legacy of commerce and growth in the area over the past 50 years, and are likely to continue into the future. Prediction of nitrate impairments in groundwater is problematic because aquifer systems have long response times and are difficult and expensive to characterize. Even with precise knowledge of land use and source loading histories, prediction of impacts to groundwater is highly uncertain and would require site controlled field assessments to differentiate specific impacts from the various sources. The biogeochemistry of nitrate significantly affects fate and transport in groundwater. Under anoxic conditions, nitrate can undergo denitrification, whereby nitrate is converted into harmless nitrogen. In addition to the challenges stated above, uncertainties exist with regards to the site specific hydrogeological processes of well pumping, recharge sources, vadose zone processes, and groundwater flow.

Historic groundwater data for the Site vicinity indicate that the upper water bearing zone and shallow water bearing zone are of poor quality and document a nitrate concentration of 84 mg/L, which is well above the maximum contaminant level of 45 mg/L. The Tracy subbasin in the vicinity of the Site is also documented by the State of California to be impaired with nitrates. Given that nitrate impacts already exist, the anti-degradation policy requires that the Water Board may not set a water quality objective less than background quality as it existed in 1968.

The results of the limited groundwater assessment suggest that the burial of dead animals has not resulted in nuisance condition and does not threaten beneficial uses of groundwater. Nitrate and nitrite concentrations were reported for all temporary wells below California maximum contaminant levels. The significant low permeable clays that underlie the Site inhibit vertical and horizontal flow and increase residence times. Corrosive soil and groundwater conditions likely accelerated the decomposition of the dead animals. Observed anaerobic conditions may be favorable to denitrification.

7.0 LIMITATIONS

Sedona Geologic has prepared this Limited Groundwater Assessment consistent with the standards of care and skill ordinarily exercised by members of the profession practicing under similar conditions in the geographic vicinity and at the time the services were performed. No warranty or guarantee, expressed or implied, is a part of this assessment.

8.0 REFERENCES

California Department of Water Resources, 2004. California's Groundwater, Bulletin 118, Updated 2006.

Hotchkiss, W.R., and Balding, G.O., 1971, Geology, hydrology, and water quality of the Tracy-Dos Palos area, San Joaquin Valley, California: U.S. Geological Survey open-file report, 107 p.

TABLES

FIGURES

APPENDIX A

NRCS Soil Survey Information

APPENDIX B

Laboratory Analytical Report and Chain of Custody Documentation – November 2012

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LIMITED GROUNDWATER ASSESSMENT REPORT

REEVE ROAD HEIFER RANCH
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SAN JOAQUIN COUNTY, CALIFORNIA

SG 1112-01

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DECEMBER 6, 2012